

## Two look-alike dasycladalean algae: *Clypeina isabellae* MASSE, BUCUR, VIRGONE & DELMASSO, 1999 from the Berriasian of Sardinia (Italy) and *Clypeina loferensis* sp. n. from the Upper Jurassic of the Northern Calcareous Alps (Austria)

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**Abstract.** New material from the Berriasian of eastern Sardinia, Italy, and from the NW of Sardinia published by PECORINI in 1972 as “*Clypeina* sp. A”, allows a better characterization and an emended diagnosis of *Clypeina isabellae* MASSE *et al.*, 1999 from the Berriasian of SW France. Another morphologically somehow similar *Clypeina* species from the Upper Jurassic of the Northern Calcareous Alps of Austria is described as *Clypeina loferensis* n. sp. Remarks on the genera *Clypeina* MICHELIN and *Hamulusella* ELLIOTT, a *Clypeina*-type dasycladalean alga with proximal bulged laterals, and *Clypeina jurassica-sulcata* are also provided.

**Key words:** Dasycladales, Green Algae, new species, emendation, Upper Jurassic, Berriasian, Northern Calcareous Alps, Sardinia.

**Апстракт.** Нови материјал из беријаса источне Сардиније, као и већ публиковани материјал од стране PECORINI-а (1972), као “*Clypeina* sp. A”, омогућио је боље сагледавање карактеристичних особина ове врсте и допунску дијагнозу за врсту *Clypeina isabellae* MASSE *et al.*, 1999 из беријаса југозападне Француске. Друга морфолошки слична *Clypeina* из горње јуре Сјеверних кречњачких Алпа, Аустрија, описана је као *Clypeina loferensis* n. sp. Дате су примедбе о роду *Clypeina* MICHELIN и *Hamulusella* ELLIOTT, као и о клипеинама са проксималним испупчењем огранака. Токође је дат осврт на однос *Clypeina jurassica* и *Cl. sulcata*.

**Кључне речи:** Dasycladales, зелене алге, нова врста, емендација, горња јура, беријас, Сјеверни кречњачки Алпи, Сардинија.

### Introduction

In 1999, MASSE *et al.* described the new dasycladalean alga *Clypeina isabellae* from the Middle–Upper Berriasian of southern France. As the description was based mainly on transverse and oblique sections, some biometric parameters (e.g. verticil spacing = h) and morphological details (e.g. connection of the laterals with the main axis) are unknown. Denoting that this species is only recorded from its type-locality, to the authors obviously escaped notice of the good illustration of the same taxon from the “Purbeckian” of NW Sardinia shown by PECORINI (1972, as *Clypeina* sp. A). Since its description, *Clypeina isabellae* was so far reported from the Upper Jurassic of Romania (BUCUR & SASARAN 2005, without illustration) the Northern

Calcareous Alps of Austria (SCHLAGINTWEIT & EBLI 2000, without illustration; SCHLAGINTWEIT 2005, *C. aff. isabellae*). Well-preserved and abundant material from the Berriasian of Eastern Sardinia allows the redescription and emendation of *Clypeina isabellae*. Additional material from the Upper Jurassic of the Northern Calcareous Alps shows the distinctiveness of the Alpine specimens, here introduced as *Clypeina loferensis* sp. n.

### Geological Setting

#### Northern Calcareous Alps

*Clypeina loferensis* n. sp. was found in brownish marly limestones (wackestones) referred to a restricted

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lagoonal facies of the Late Jurassic shallow-water evolution of the Northern Calcareous Alps known as Plassen Carbonate Platform, respectively the so-called Lärchberg Formation (FERNECK 1962; DARGA & SCHLAGINTWEIT 1991; DYA 1992; SCHLAGINTWEIT & EBELI 2000; SCHLAGINTWEIT 2005; SANDERS *et al.* 2007, for details). Rarely, the new species occurs also in mass-flows of the Barmstein Limestones containing clasts of PCP lagoonal facies (STEIGER 1981; GAWLICK *et al.* 2005).

Based on previous studies on the facies evolution of the Plassen Carbonate Platform (e.g. SCHLAGINTWEIT *et al.* 2005) and the accompanying microfossils, *Clypeina loferensis* sp. n. was identified in samples ranging from Late Kimmeridgian to Tithonian (?Early Berriasian). The samples containing the new species are coming from the following localities.

**Mount Dietrichshorn.** Mount Dietrichshorn is located about 3 km north of Lofer, topographic map of Austria no. 92, sheet Lofer. The Lärchberg Formation of Mount Dietrichshorn was investigated by DARGA & SCHLAGINTWEIT (1991) and DYA (1992).

**Mount Lärchberghörndl.** Mount Lärchberghörndl and its eastern part, the Lofer Kalvarienberg, are the type-locality of the Lärchberg Formation established by FERNECK (1962). Topographic Map of Austria no. 92, sheet Lofer. Literature: DYA (1992), FERNECK (1962). Mount Lärchberghörndl is the type-locality of *Clypeina loferensis* sp. n. (Fig. 1). Samples were taken at the way along the Loferbach (samples LOF) and the so-called Konradsweg (KOWG) and Ensmannsteig (ENS).

**Mounts Litzelkogel-Gerhardstein.** Lärchberg Formation. Topographic map of Austria no. 92, sheet Lofer. Literature: DYA (1992), FERNECK (1962), not DYA (1962).

**Mount Trisselwand.** Plassen Formation. East of Lake Altaussee. Topographic map of Austria no. 96, sheet Bad Ischl. Literature: SCHLAGINTWEIT & EBELI (1999).

**Mount Zwerchwand.** Barmstein Limestones. Mount Zwerchwand is located near Bad Goisern in the central Salzkammergut area. Topographic Map of Austria no. 96, sheet Bad Ischl. The occurring Barmstein Limestones (mass-flows, breccias, calciturbidites) are intercalated in calpionellid-bearing limestones. Late Tithonian is evidenced by the occurrence of *Crassicollaria intermedia* (DURAND-DELGA).

## Sardinia

Within the ambit of studies on the sedimentary cover of Eastern Sardinia, which have continuing for many decades at the Department of Geosciences of the University of Padova, detailed litho- and biostratigraphic analyses have been carried out on the carbonate platform deposits of Late Jurassic–Early Cretaceous age cropping out in the Oliena–Orgosolo–Urzulei massif (the so-called Supramonte). These researches have led to findings of abundant macro- and micropalaeontological associations. In particular, as regards calcareous algae, as well as spe-

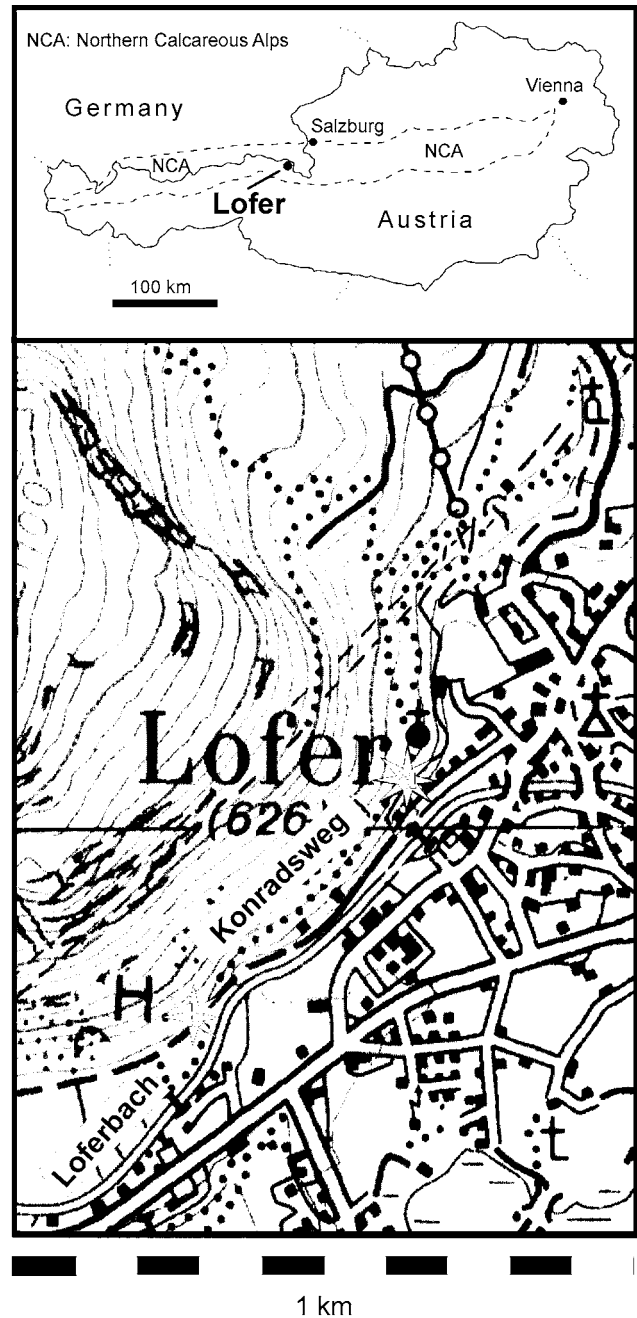


Fig. 1. Topographic sketch map of the type-locality of *Clypeina loferensis* n. sp. near the village of Lofer, Austria.

cies already quoted in the literature for Sardinia and other European regions, forms not referable to any known taxa were identified. Among these, *Clypeina dragastani* and *Salpingoporella granieri* were erected by DIENI & RADOIČIĆ (2000) for dasycladaleans occurring in beds of Early Berriasian age of the Sa Marghine Ruja section, in the Oliena territory (Fig. 2). This section represents the terminal part of the very thick Mt. Bardia Limestone formation, the age of which is Tithonian to Berriasian in most areas, but locally extending downwards into Kimmeridgian and Oxfordian. The Tithonian–Berriasian interval of the lithostratigraphic unit is

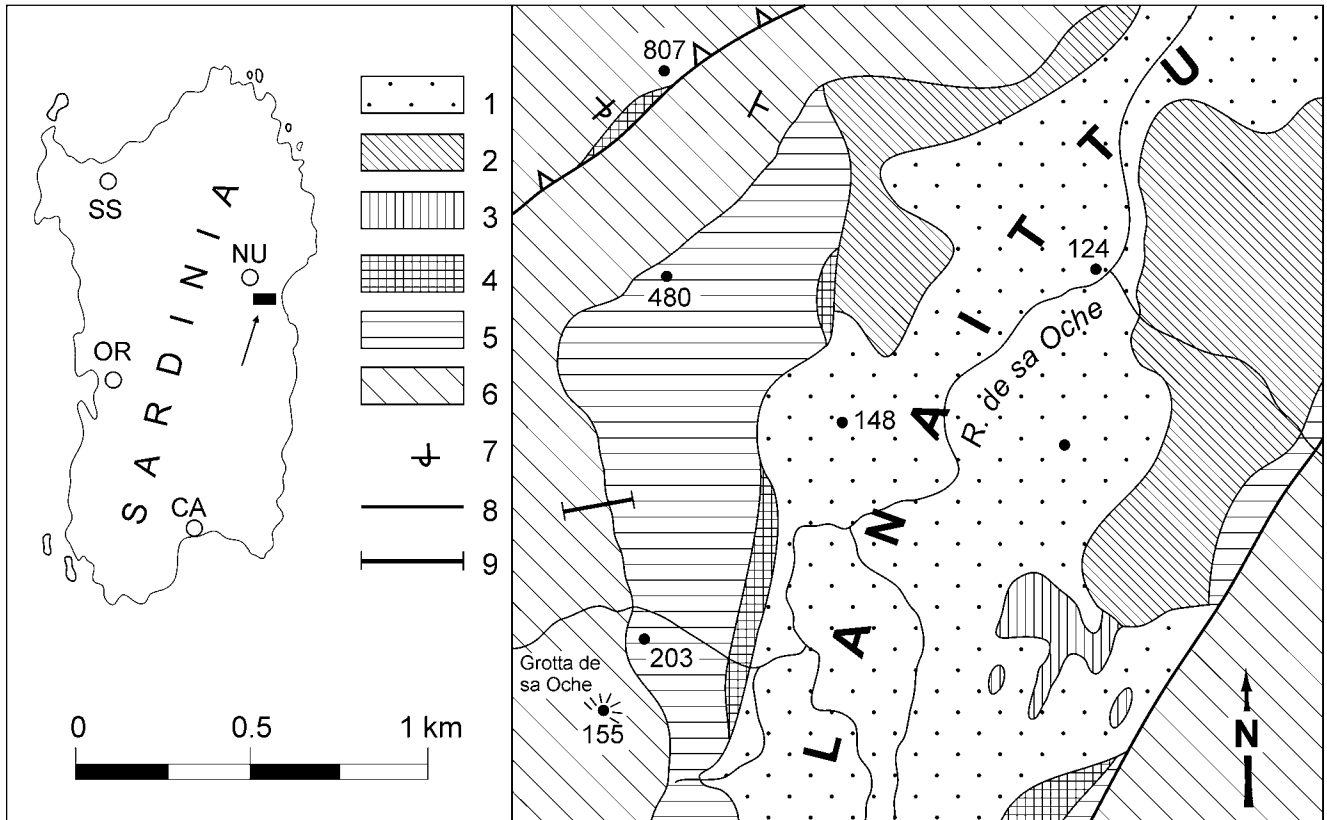


Fig. 2. Geological sketch map of the Lanaittu area (Oliena, Eastern Sardinia). 1, Quaternary deposits; 2, Lutetian polymictic conglomerates (Cuccuru 'e Floras Conglomerate); 3, Upper Santonian–Maastrichtian marls (Lanaittu Marl); 4, Upper Cenomanian–Lower Santonian marly and in places cherty limestones (Gorropu limestone); 5, Valanginian–Upper Aptian marls and limestones (Orudè Calcarenite–Borrosca Limestone); 6, Bathonian–Berriasian dolostones and limestones (Dorgali Dolostones and Monte Bardia Limestone); 7, Overturned beds; 8, Fault; 9, Sa Marghne Ruja section (from DIENI *et al.* 2000, modified).

characterized by a rather uniform facies association, corresponding to a generalized peritidal environment with well-developed microbial mats and fine-grained fenestral limestones. A regressive acme is reached in the upper part of this complex, which is marked by many horizons of black-pebble breccias, mud-cracked laminites and oligotypic assemblages consisting of charophytes, ostracods and small mollusks suggesting a scenario of wide supratidal flats disseminated with lagoonal to fresh-water ponds. The succession is commonly split into a number of high-frequency metre-scale cycles (DIENI & MASSARI 1985).

One of the best exposures illustrating the peritidal deposits is just that of Sa Marghine Ruja (Fig. 3), where the depositional pattern shows the characters of the well-known ‘‘Purbeckian facies’’. This section (illustrated by DIENI & MASSARI 1985 under the name of ‘‘Sa Oche section’’) is located within the Lanaittu valley, which is a structural depression corresponding to an asymmetric syncline bounded by a NNE-trending fault system on the eastern side (Fig. 2). Within the mud-cracked almost barren laminated facies, volumetrically dominant, a number of packstone layers are intercalated, rich in microfossils of restricted environment, peloids and flat intra-

clasts. These facies are thought to represent the record of storm flows intermittently encroaching on mud-cracked supratidal flats and depositing their load from suspension. A slight transgressive trend and increasing open-marine influence is suggested by the upward increment in number of these layers and appearance in the uppermost layer package of higher-diversity fauna and flora.

In the Sa Marghine Ruja section, the Tithonian–Berriasian boundary can be traced with sufficiently good approximation only by means of the content in plant remains, since foraminifers give no significant information from the bio- and chronostratigraphic viewpoint. The boundary may be located approximately between beds 848 and 851 (the sample numbers were marked with colored enamel paint on the beds cropping out along the studied succession). As regards Dasycladales, starting from bed 857, in addition to species already quoted in the Upper Jurassic, such as *Actinoporella podolica* (ALTH), *Clypeina maslovi* (PRATURLON), *Clypeina solkani* CONRAD & RADOIĆIĆ, *Otternstella lemensis* (BERNIER) and *Salpingoporella annulata* CAROZZI there are taxa which, at least until now, have only been recorded beginning from the Berriasian, such as

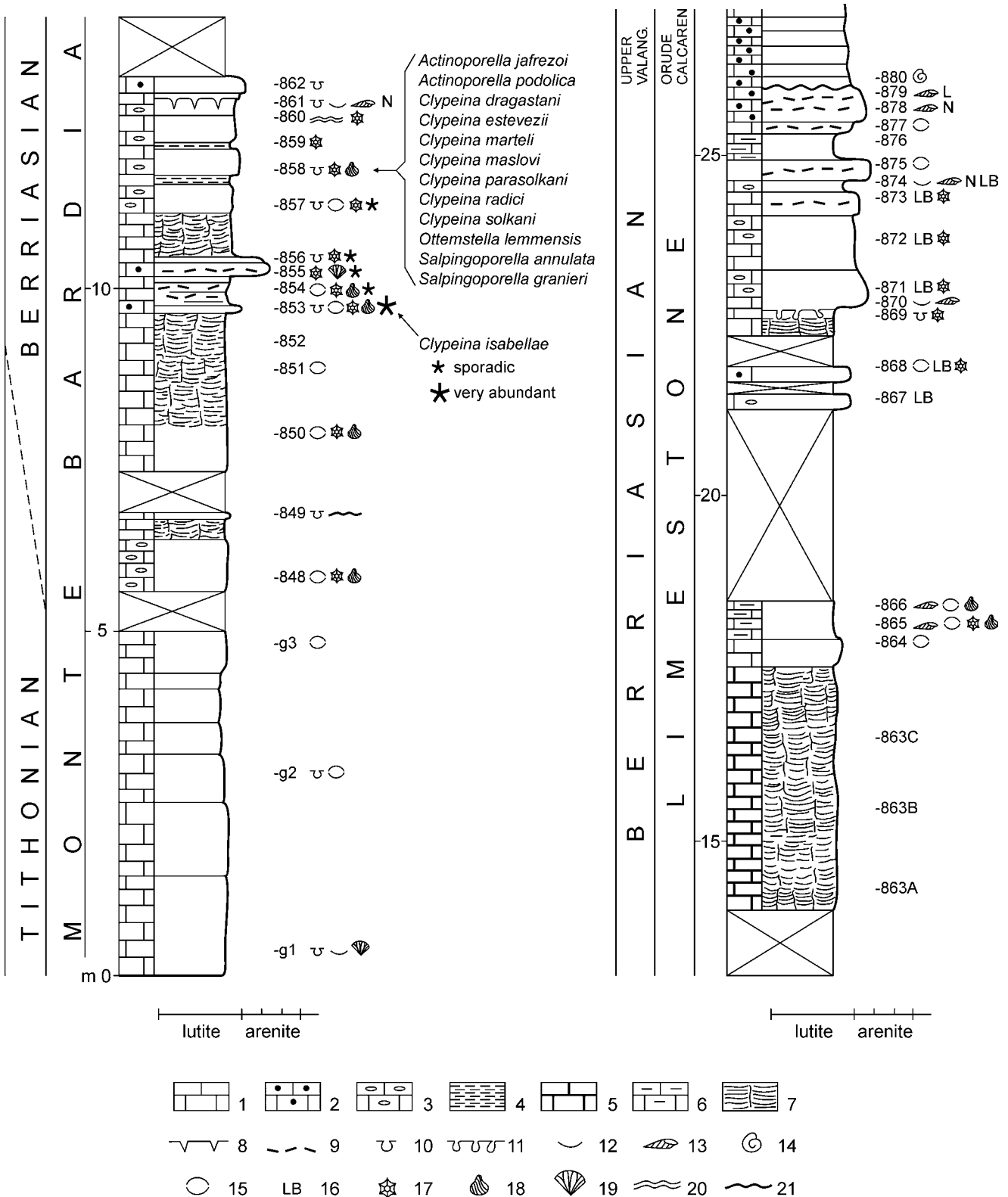


Fig. 3. Sa Marghine Ruja section (Oliena, Sardinia) (from DIENI *et al.* 2000). Legend: 1, Limestone; 2, Bioclastic limestone; 3, Nodular, stylolite-bearing limestone; 4, Crumbly limestone; 5, Fine-grained limestone subdividing into flakes; 6, Marly limestone; 7, Mud-cracked, thin-laminated calcilitute; 8, Mud-cracks; 9, Intraformational clasts, commonly blackened by organic matter; 10, Burrows; 11, Borings by bivalves; 12, Bivalves; 13, Gastropods, mostly nerineids(N); 14, Ammonites; 15, Ostracods; 16, Lithocodium-Bacinella; 17, Dasycladaleans; 18, Charophytes; 19, Codiaceans; 20, Algal lamination; 21, Disconformity.

*Actinoporella jaffrezoi* GRANIER, *Clypeina estevezii* GRANIER, *Clypeina parasolkani* FARINACCI & RADOIČIĆ and *Salpingoporella granieri* DIENI & RADOIČIĆ. In addition, in this bed 857 and downwards until bed 853 (for a total thickness of about 170 cm) is just present *Clypeina isabellae* MASSE, BUCUR, VIRGONE & DELMASSO, subject of this note, and until now only known from the Berriasian of Provence (SE France, Fig. 4) (“l’espèce n’est pas pour le moment connue que du Berriasien moyen et supérieur de Basse Provence. La difficulté de separer clairement le Berriasien inférieur du Berriasien moyen conduit a penser qu’elle pourrait exister dès le Berriasien inférieur”, MASSE *et al.* 1999, p. 240).

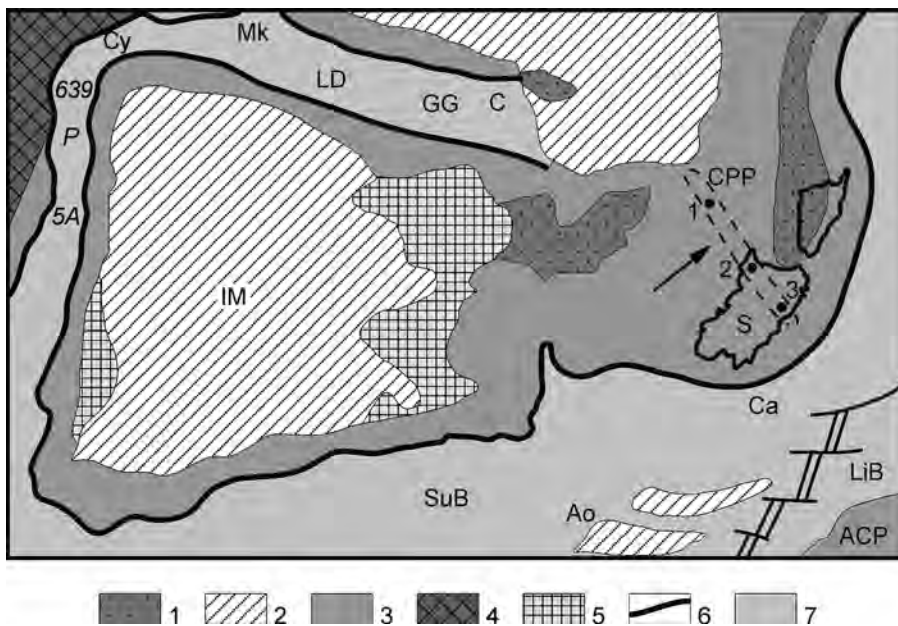


Fig. 4. Partial Late Tithonian–Berriasian palaeoenvironmental map of the western Mediterranean area (from FOURCADE *et al.* 1993, simplified and modified, approximative scale 1 : 400 000). Legend: **1**, Exposed land; **2**, Margin-litoral and lacustrine environments; **3**, Shallow platform; **4**, Terrigenous shelf and shallow terrigenous basin; **5**, Chalky platform; **6**, Slope or shelf edge/slope boundary; **7**, Slope and deep basin above CCD. S – Sardinia (for the other acronyms see FOURCADE *et al.* 1993). Dashed line – Possible “endemism” area of *Clypeina isabellae* (1. Provence, 2. Western Sardinia, 3. Eastern Sardinia).

### Micropalaeontological Part

Order Dasycladales PASCHER, 1931

Genus *Clypeina* (MICHELIN 1845) BASSOULLET *et al.* 1978

#### *Clypeina loferensis* sp. n.

Fig. 5 A–J; Pl. 1, Figs. 1–17,

1985 *Clypeina* sp. A PECORINI – BERNIER: 487, pl. 8, figs. 1–7.

1992 *Actinoporella podolica* (ALTH) – DYA: 68, pl. 7, figs. 6–8.

?1996 *Clypeina* aff. *parasolkani* RADOIČIĆ & FARINACCI – ERCEGOVAC, JEREMIC & RADOIČIĆ: pl. 2, figs. 1–9.

2005 *Clypeina* aff. *isabellae* MASSE *et al.* – SCHLAGINTWEIT: pl. 2, fig. 11.

*Origin of the name.* The specific name refers to the village of Lofer, near the German–Austrian border (Fig. 1).

*Holotype.* Oblique transverse section figured in Pl. 1, fig. 9, thin-section BSP-2009-XI-1, deposited at the Bayerische Staatssammlung für Paläontologie und Historische Geologie (BSP), University of Munich, also other 9 thin-sections (BSP-2009-XI-2 to -10). For the type-locality the original sample numbers referring to the indications in textfigure 1 are given.

*Isotypes.* All other figurations.

*Type-locality.* The so-called Konradsweg along the Lofer Kalvarienberg and the SE slope of the Lärchberghörndl, located on the topographical map of Austria 1:50 000 ÖK 92 Lofer (Fig. 1). This locality corresponds to the profile no. 7 described by DYA (1992: p. 22–24) and is also the type-locality for *Carpathocancer? plassenensis* (SCHLAGINTWEIT & GAWLICK) (SCHLAGINTWEIT *et al.* 2003, Fig. 1) (coordinates: length 12°41', width 47°35').

*Type-level.* Light brown wackestone of the Lärchberg Formation *sensu* FERNECK (1962) containing stromatoporoids, *Clypeina loferensis* sp. n., *Salpingoporella annulata* CAROZZI, *Rajkaella* gr. *bartheli* (BERNIER), *Clypeina catinula* CAROZZI, *Clypeina jurassica* FAVRE & RICHARD, more rarely *Deloffriella quercifoliipora* GRANIER & MI-

CHAUD and benthic foraminifers among which *Anchispirocyclina lusitanica* (EGGER).

*Age.* Tithonian, presumably Late Tithonian.

**Diagnosis.** Medium-sized dasycladalean alga with clearly spaced-out laterals inclined upwards 60°–80° in respect to the main stem, euspondyl in arrangement. Laterals elongate, fusiform, and connected to the small main stem starting from a comparatively narrow pore. Along their distal half the laterals are clearly separated from each others. Thin calcification covering main axis and laterals.

**Dimensions.** Outer thallus diameter (D) 0.48–1.92 mm (mean value: 0.79 mm, n = 11); inner thallus diameter

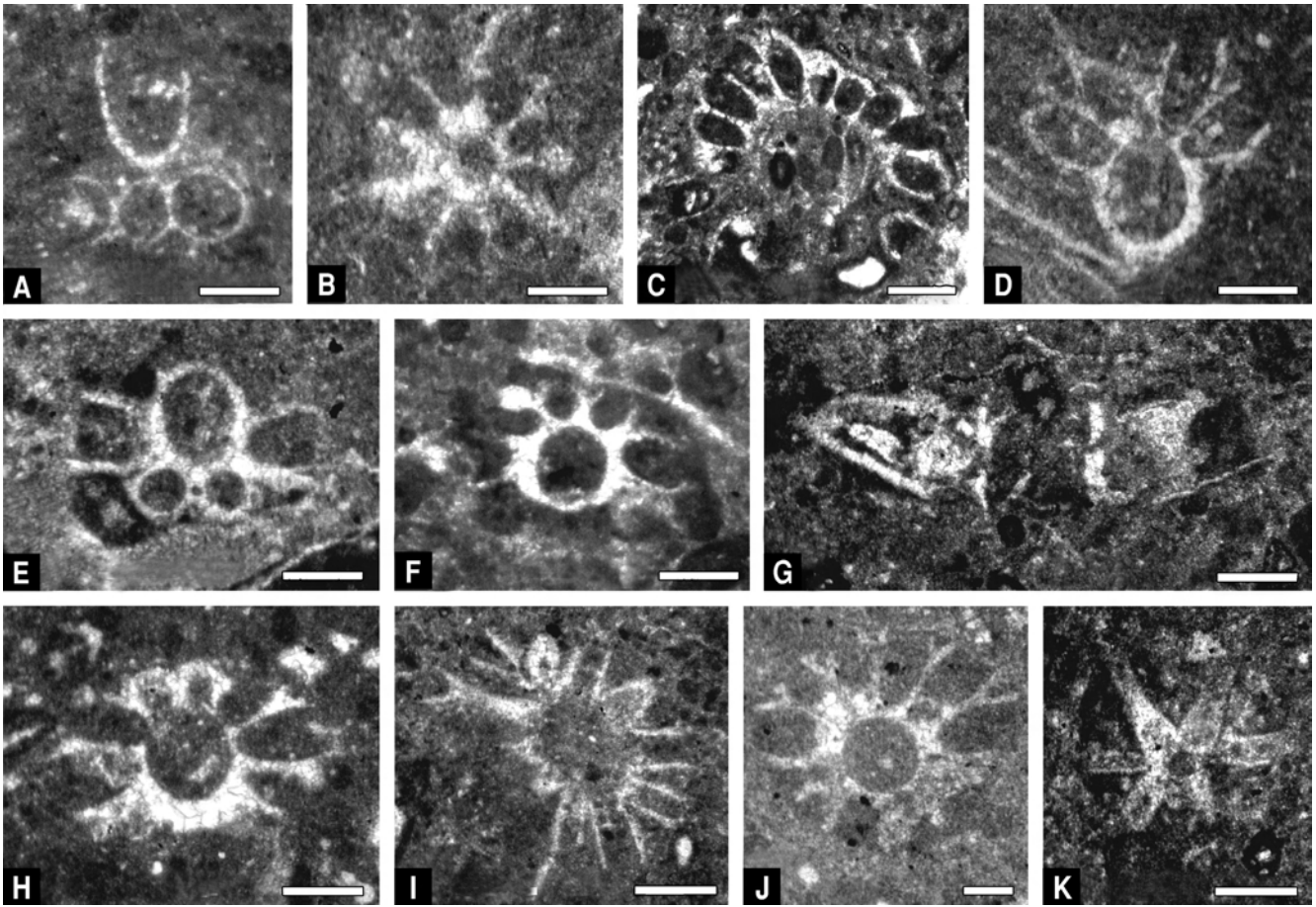


Fig. 5. *Clypeina loferensis* n. sp. (A–J) and *Clypeina* sp. (K) from the Upper Jurassic (Kimmeridgian–Tithonian) of the Northern Calcareous Alps (Austria, Germany). **A**, Tangential-oblique section, sample LOF-3, Lofer Kalvarienberg-Lärchberghörndl; **B**, Transverse section, slightly oblique, sample DIE-163, Mount Dietrichshorn; **C**, Oblique section of a specimen with comparable large main axis and unusual high number of laterals (?17), sample Die-Gipfel, Mount Dietrichshorn; **D–F**, Oblique sections, samples ENS-1, LOF-2 and DIE-8; **D–E**, Lofer Kalvarienberg-Lärchberghörndl; **F**, Mount Dietrichshorn; **G**, Longitudinal section, cutting one verticil; note upward bending of laterals, sample EIS-7, Lofer Kalvarienberg-Lärchberghörndl; **H–I**, Oblique-transverse sections, sample DIE-164, Mount Dietrichshorn; **J**, Transverse section, slightly oblique, sample DIE-165, Lofer Kalvarienberg-Lärchberghörndl; **K**, Transverse section of *Clypeina* sp. with tiny main axis, low number of nearly unfused laterals interpreted as top part of the thallus, sample EIS-7, Mount Dietrichshorn. Scale bars = 0.3 mm.

(D) 0.06 mm to 0.8 mm (mean value: 0.19 mm,  $n = 20$ ). Due to the many oblique sections in our material and the inclination of the laterals only few data about the  $d/D$  ratio are available ranging from 0.24 to 0.32 mm (mean value 0.27,  $n = 8$ ). For the verticil spacing ( $h$ ) only two values are available, 0.32 and 0.4 mm. The maximum pore diameter ( $p$ ) is 0.145–0.16 mm. Number of laterals/whorl ( $w$ ): 8–16 (most values between 10–12).

**Description.** Medium-sized representative of *Clypeina* with a small main axis amounting to less than 1/3 of the total diameter. Calcification of laterals and main axis is thin (thickness 0.02 to 0.04 mm). Due to the weak calcification of the main axis, longitudinal sections comprising two or more consecutive whorls are rare; in no case more than two verticils were observed (Pl. 1, fig. 4). Secondary non-fibrous calcifi-

cation present at the base of the laterals. Most probably the distal parts of the laterals were poorly if at all calcified, open to its exterior. Laterals are elongate-tubiform, inclined to the main axis ( $60^\circ$ – $80^\circ$ ), connected to the axis by a small pore (Pl. 1, figs. 1, 5). Due to their inclination, the laterals show a slight asymmetry in longitudinal sections (Fig. 5G). The upper side more or less directly stretches away from the axis, whereas the lower side of the lateral is a little bit more rounded, however, without forming a downward bulging. Transverse sections through the lower part of a verticil with less inclined laterals give rise to a more regular rosette (Pl. 1, figs. 2, 11); in these cases laterals are circular to ovoid in longitudinal sections. The laterals stay in contact for 1/3 to 1/2 of their length before becoming untouching, individualized. Normally,

the laterals are gradually widening, seemingly becoming narrower again toward their distal ends. The verticils are rather widely spaced-out.

**Comparisons.** *Clypeina loferensis* sp. n. is closely related to *Clypeina isabellae* MASSE *et al.* differing from this species above all by the lack of a bulge at the lower side of the lateral's proximal parts. Moreover, the observed intralateral fibrous calcification of *C. isabellae* and *C. jurassica* is missing in *C. loferensis* sp. n. Both species share similar dimensions also with a comparable variation grade of rare tiny and large specimens; the weak calcification of the membran of the laterals is present in both species.

**Occurrences.** Austria (Northern Calcareous Alps, this work), Montenegro, Switzerland (?) (see synonymy).

*Clypeina isabellae* MASSE, BUCUR, VIRGONE & DELMASSO, emend.

Pl. 2, Figs. 1–24; Pl. 3, Figs. 1–20

1972 *Clypeina* sp. A – PECORINI: 378, fig. 3, a–f, non g and h.

?1998 *Clypeina* sp. A PECORINI – EBLI & SCHLAGINTWEIT: 15–16, pl. 3, figs 1, 7, ?9.

non 1985 *Clypeina* sp. A PECORINI – BERNIER: 487, 746, pl. 8, figs. 1–7.

1999 *Clypeina isabellae* nov. sp. – MASSE, BUCUR, VIRGONE & DELMASSO: 237, pl. 2, figs. 1–8.

**Original diagnosis.** Petite espèce de *Clypeina* à thalle calcifié fibreux jaunâtre, à ramifications fertiles courtes, peu nombreuses, de section subcirculaire, soudées sur la plus grande partie de leur longueur (MASSE *et al.* 1999, p. 237).

In the description of their taxon, the authors furthermore added that the laterals are connected to the main axis by a short peduncle, poorly if at all recognizable in the original figurations.

**Emended diagnosis.** Tallus of elongate-cylindrical main axis bearing spaced-out fertile whorls of horizontal or slightly upward inclined (up to 16°) laterals. Relatively large tubular fertile laterals, containing ampulla, of slightly irregular shape with a small bulge on the lower side immediately near the main axis; in transverse section they are distally somewhat narrower. The skeleton prevailing consists of fibrous yellowish calcite, but also of colorless calcite. Individual calcification of laterals affects only their proximal and middle part, whereas the distal area is uncalcified. Main axis is feeble calcified. Very thin primary calcification characterizes also the wall of laterals, while yellowish calcite is intracellular deposition, usually united with wall skeleton by recrystallization.

**Dimensions.** The size of the Sardinian specimens varies more than 1: 3. D: 0.23–0.74 mm, d: 0.081–0.31 mm. The number of laterals per whorl is 6–15, generally varies between 10–12, rarely arrived to 14, exception-

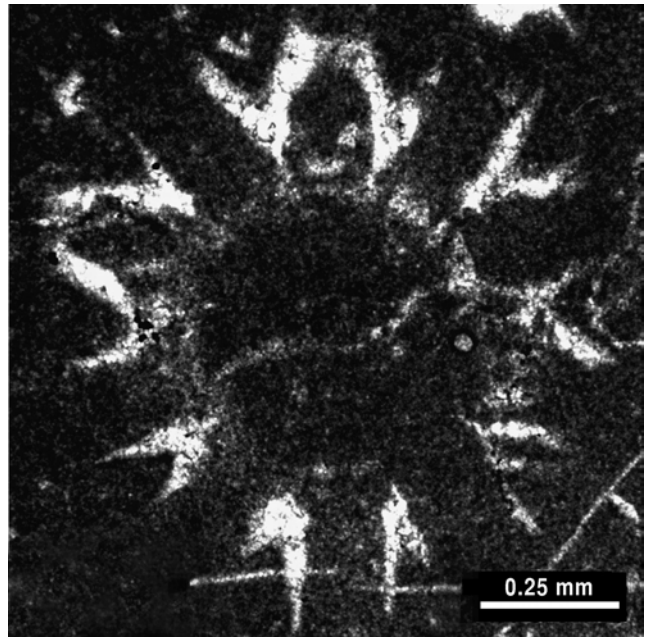


Fig. 6. *Clypeina* cf. *isabellae* (= *Clypeina* A PECORINI, 1972, fig. 3d). Nura, NW Sardinia.

al are 6 or 15 laterals. Amongst the small-sized specimens, that one with an inner diameter of 0.123 mm and 10–11 laterals and another with 6 laterals and an inner diameter from 0.081 to 0.125 mm are worth noting (Pl. 2, Figs. 19, 22). Distance between consecutive whorls 0.020–0.030 mm. The main axis diameter is nearly of the same value as the length of the calcified part of the laterals, only sometimes larger and exceptionally smaller. Unique, extremely large specimen, here presented as *Clypeina* cf. *isabellae* (Fig. 6) derives from the Purbeckian of NW Sardinia (Nurra) illustrated by PECORINI (1972, Fig. 3d). The dimensions of this specimen (D: 1.15 mm, d: 0.48 mm) were obtained from the thin-section of the PECORINI collection. The similar example of an extreme large specimen in the population of *Clypeina marginiporella* MICHELIN was presented by GÉNOT (1987, pl. 26, fig. 1) as *C. cf. marginiporella*.

**Description.** As the main axis is weakly calcified, scattered individual whorls are prevailing, rarely two successive whorls, or, exceptionally four whorls as those in Pl. 2, Fig. 18, are preserved. Whorl rosette generally has very regular shape; in specimens with elevated number of lateral they are irregularly composed, somewhat overlapped (Pl. 2, Figs. 5, 14). Adjacent laterals, depending of their number per whorl, may be more or less fused. In some very deep tangential section of specimens with elevated *w* number they occur, along fused portion, laterally congested having flattened shape (Pl. 2, Fig. 10). The bulge in the initial portion of whorl is clearly visible in number of longitudinal and different tangential sections shown on Plates 3 and 4. In transverse sections through the lower

part of the whorl, the bulges occur as small circles around the main axis (Pl. 2, Figs. 1, 8), and this results also in some oblique sections (Pl. 3, Fig. 16). Ampullae are rarely preserved, usually as remains of calcite filling (Pl. 2, Figs. 15, 18, 21). Only well preserved ampulla (Fig. 7; Pl. 2, Fig. 9) is enclosed in intracellular calcification (as in *Clypeina jurassica*, Figs. 8A, B).

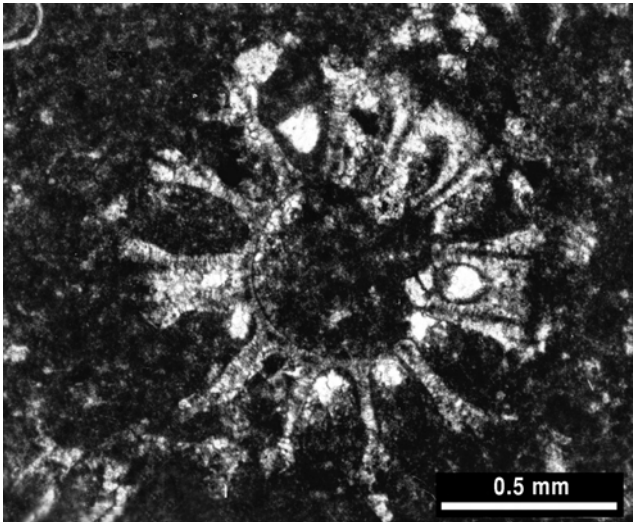


Fig. 7. *Clypeina isabellae* MASSE, VIRGONO & DELMASSO (= Pl. 2, Fig. 9), transverse section with well preserved ampulla enclosed in the intracellular calcification, from the Upper Jurassic of Podgorica, Montenegro.

**Relationships.** *Clypeina isabellae* is related to the group of *Clypeina* species characterized by a more or less expressed bulge on the proximal lower side of lateral's wall (= small lower protuberance of DE CASTRO, 1997, pl. 20, fig. 1) including *Cl. digitata* (PARKER & JONES), *Cl. neretvae* RADOIČIĆ, *Cl. inopinata* FAVRE, *Cl. jurassica* FAVRE & RICHARD, *Cl. ? sedalanensis* ELLIOTT, and *Cl. liburnica* RADOIČIĆ. It is especially similar to *Cl. inopinata* and *Cl. jurassica* having intracellular filling by fibrous yellowish calcite, but differs in form of laterals.

Species with larger bulges such as *Cl. ? sedalanensis* and *Cl. liburnica*, according to BARATTOLO (1998, p. 84), belong to genus *Hamulusella* ELLIOTT as the "short proximal portion below the junction point" of the primary lateral "... is not visible or recorded in the type-species of *Clypeina*". Consequently, the question is: which value of the bulge size can be taken as genus specific and is it an important character for distinguishing the two genera *Clypeina* and *Hamulusella*? Noteworthy, that the genus *Hamulusella* was considered a junior synonym of *Actinoporella* by GRANIER (1994), a view that is not followed here (see also BARATTOLO, 1998); other authors, though recognizing its affinities to *Clypeina*, maintained its validity (DELOFFRE & GÉNOT 1982; DELOFFRE 1988; DELOFFRE & GRANIER, 1992; GRANIER & DELOFFRE 1993).

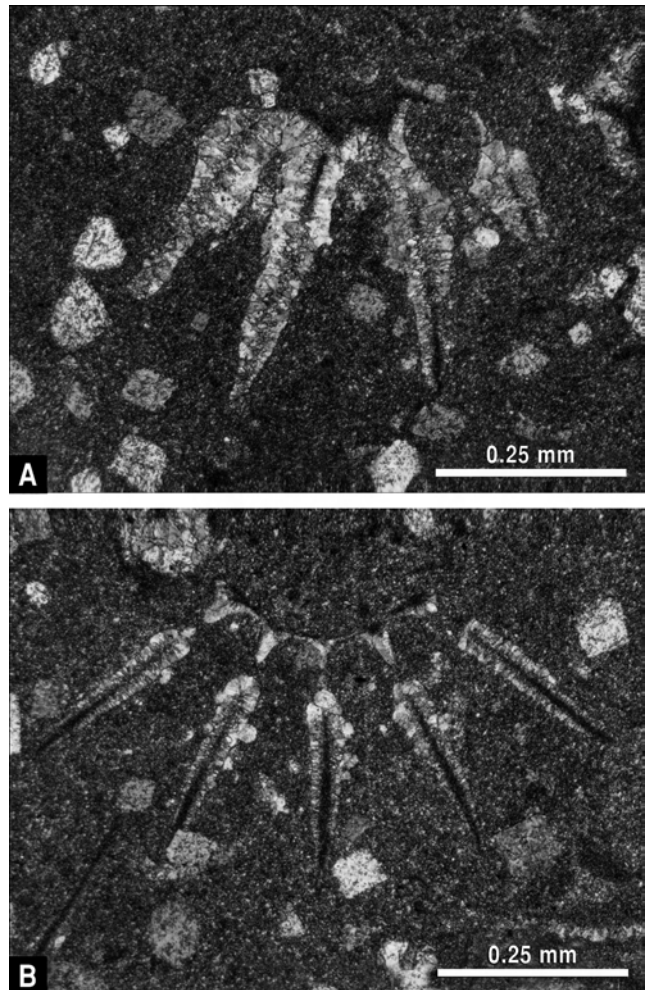


Fig. 8A, B. *Clypeina jurassica* FAVRE & RICHARD, fragments of transversal sections with imprints of ampulla, from upper Jurassic of Podgorica, Montenegro, thin section RR1015.

**Occurrences.** *Clypeina isabellae* is so far known from SE France (type-area) and Sardinia (Fig. 4).

The thin-sections with *Clypeina isabellae* MASSE *et al.* from the Berriasian of Sardinia are housed in the Museo di Geologia e Paleontologia, University of Padova.

### Remarks on *Clypeina jurassica* FAVRE & RICHARD – *Clypeina sulcata* (ALTH) relationships

*Actinoporella sulcata* (ALTH) is known only as an imprint of transversal whorl's section from the Upper Jurassic Nizniów Limestone of the Ukraine illustrated by PIA (1920, Pl. 7, Fig. 8). Since that time, the species has not again been identified. RADOIČIĆ (1969) mentions that *Actinoporella sulcata* more appropriate to some *Clypeina* (cf. *jurassica*?). With respect to PIA's illustration, CONRAD *et al.* (1974) stated that undoubtedly there is a close resemblance to *Clypeina jurassica* or *Clypeina inopinata*, thus, necessitating the study



of further material from its type locality. In the monography of Jurassic–Cretaceous dasycladaleans provided by BASSOULET *et al.* (1978, p. 32), *Actinoporella sulcata* (was regarded a synonym of *Clypeina jurassica* although the former was described prior to the latter.

GRANIER & BRUN (1991) were considering *Clypeina jurassica* as a junior synonym of *Clypeina sulcata* without going further into discussion. Consequently, *C. jurassica* was not included in the “Critical Inventory” provided by GRANIER & DELOFFRE (1993). It is worth mentioning that no *sulcata* specimen or fragment was identified in 6 samples (8 thin slides, R.R.) from the type-locality which were kindly collected by S. PASTERNAK (The National Academy of Sciences of Ukraine). Even in case where *Clypeina jurassica* (not *inopinata*) would be documented as junior synonym of *Clypeina sulcata*, there would be some solid arguments in favour of retaining the name *jurassica* as *nomen conservandum*. The present authors will refer to the General Committee of ICBN with an appropriate recommendation for a ruling this matter.

## Acknowledgements

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## Резиме

### Двије сличне дазикладацејске алге: *Clypeina isabellae* Masse, Bucur, Virgone & Delmasso, 1999 из беријаса Сардиније (Италија) и *Clypeina loferensis* sp. n. из горње јуре Сјеверних кречњачких Алпа (Аустрија)

На основу богатог фосилног материјала из беријаских седимената западне (PECORINI 1972) и источне Сардиније (I. DIENI), дата је допунска дијагноза за врсту *Clypeina isabellae* MASSE *et al.*, 1999, која је била описана из беријаских седимената Провансе, а на основу пресека који нијесу могли дати све податке о њеној грађи. Притом, аутори су превидели рад PECORINI (1972) у којем је ова врста била приказана као *Clypeina* sp. A. Овом приликом уводи се *Clypeina loferensis* sp. n. из горње јуре Сјеверних кречњачких Алпа која у неким пресецима има сличност са *Clypeina isabellae*.

#### *Clypeina loferensis* sp. n.

**Холотип:** искошен попречан пресјек приказан на Табли 1, сл. 9, преп. BSP-2009-XI-1.

**Дијагноза:** Дазикладаца средње величине са равномјерно распоређеним пршљеновима огранака, под нагибом 60°-80° према главној оси, који су еуспондилно распоређени.

Огранци су фусиформног облика, проксималним дилелом у латераном контакту, дистално слободни. Калцификација је обухватала дио пршљена око главне осе и знатан дио огранака.

#### *Clypeina isabellae* (MASSE *et al.*, 1999)

**Допуњена дијагноза:** Талус главне осе издужено-цилиндричног облика са пршљеновима хоризонталних или благо навише нагнутих огранака. Релативно крупни тубиформни огранци (са ампулом) благо су неправилног облика са малим испупчењем у доњем проксималном дијелу. У попречном пресеку огранци су незнатно дистално сужени. Скелет чини фиброзни чућкаси калцит, али такође и безбојни калцит. Веома танка примарна калцификација захватала је зид гравне осе огранака, док је жућкасти калцит депонован интрацелуларно, а често прекристализацијом сједињен са танким скелетом зида.

*Clypeina isabellae* је сродна групи клипеина са мање или више израженим проширењем на доњој страни огранака, уз главну осу. У највећој мјери је сродна врстама *Clypeina jurassica* и *Cl. inopinata* које се такође карактеришу интрацелуларним испуње-

њем фиброног калцита, али се од ових разликује обликом огранака.

### **Однос *Clypeina jurassica* – *Clypeina inopinata***

*Actinoporella sulcata* (ALTH, 1878), описана из горњојурског кречњака Нижњева (Украјина), била је позната само на основу једног отиска трансверсалног пресека који је приказао PIA (1920; таб. 7, сл. 8). Од тада није била идентификована. У шест узорак (8 препарата, Р.Р.) који су љубазно добијени од С. ПАСТЕРНАКА (Украјинска Академија Наука) није

нађен ни један пресјек или фрагмент ове врсте. RADOIČIĆ (1969) помиње да је *A. sulcata* слична некој клипеини (cf. *jurassica*?). CONRAD *et al.* (1974) потврђују њену несумњиву сличност са *Clypeina jurassica* или *Cl. inopinata* и упућују на потребу даљег проучавања материјала из типског локалитета.

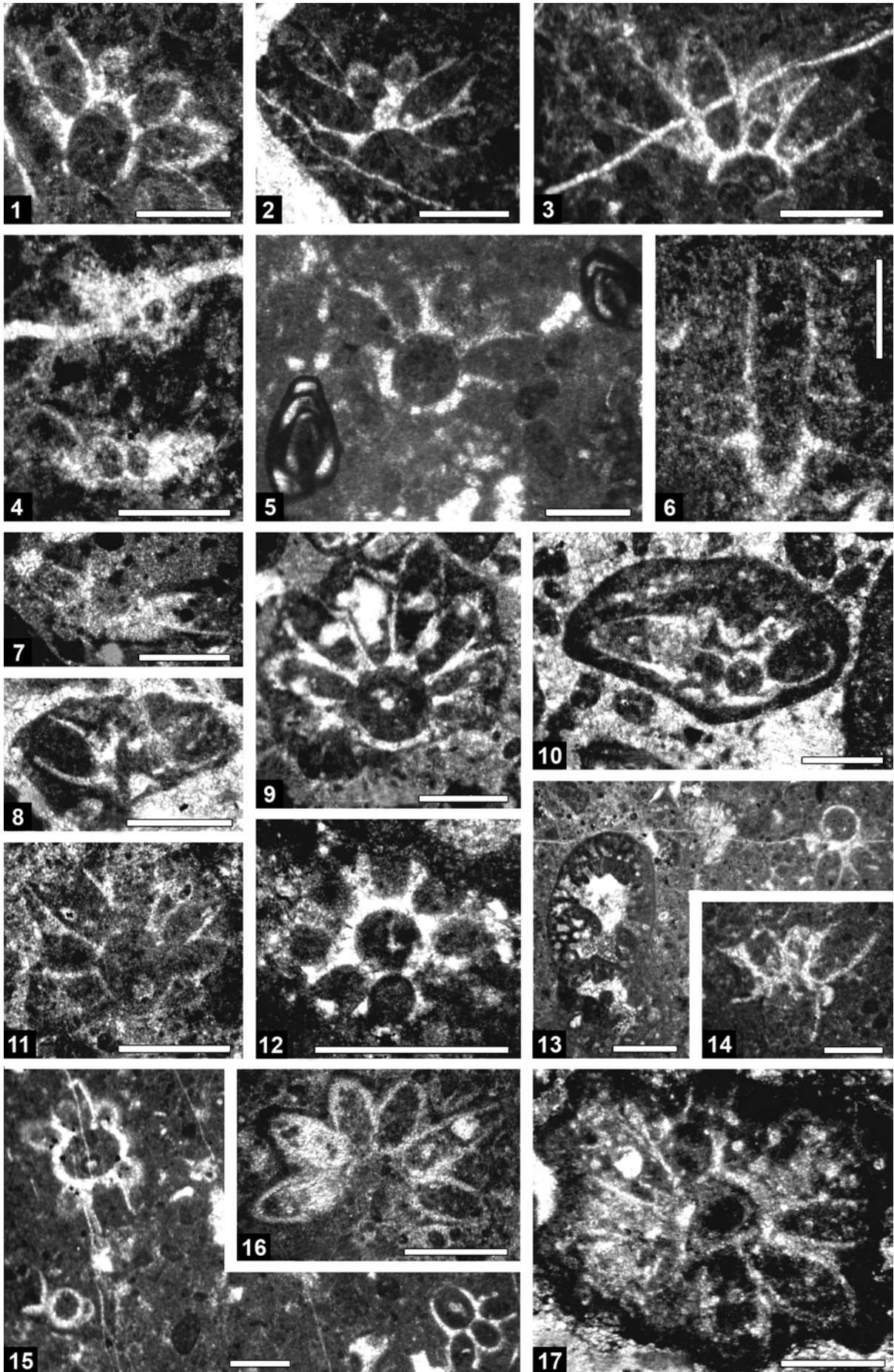
Према GRANIER & BRUN (1991), *Cl. jurassica* млађи синоним врсте *Cl. sulcata*, не улазећи у дискусију о овој материји, аутори сматрају да постоје, чак и у случају ако се потврди да је *Clypeina jurassica* (не *inopinata*) млађи синоним врсте *Cl. sulcata*, веома јаки аргументи да се специфичко име *jurassica* задржи као *nomen conservandum*.

## PLATE 1

*Clypeina loferensis* n. sp. from the Late Jurassic (Kimmeridgian–Tithonian)  
of the Northern Calcareous Alps (Austria, Germany)

- Figs. 1–2. Oblique sections, samples DIE-164 and ENS-1; 1, Lofer Kalvarienberg-Lärchberghörndl; 2, Mount Dietrichshorn.
- Fig. 3. Oblique section, sample MT-947, Mount Trisselwand.
- Fig. 4. Longitudinal section cutting two verticils; note upward bending of laterals, sample KOWG-1, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 5. Oblique section, sample E 109, Mount Zwerchwand.
- Fig. 6. Longitudinal-oblique section, sample LK 3, Mount Litzelkogel.
- Figs. 7–8. Longitudinal sections, slightly oblique, samples LOF-2 and KOWG-D, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 9. Holotype, oblique transversal section, sample LOF-1, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 10. Oblique-tangential section through one verticil, sample Die-170, Mount Dietrichshorn.
- Fig. 11. Oblique-transverse section, sample KOWG-B, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 12. Transverse section with 8 laterals, sample KOWG-D, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 13. Wackestone with *Pseudocyclamina* cf. *lituus* (YOKOYAMA) (left) and *Clypeina loferensis* n. sp. (right), sample MT-323, Mount Trisselwand.
- Fig. 14. Oblique section; note comparable thin calcification covering the main axis, sample DIE-642, Mount Dietrichshorn.
- Fig. 15. Wackestone with several sections of *Clypeina loferensis* n. sp., sample MT-947, Mount Trisselwand.
- Fig. 16. Oblique-transverse section, sample KOWG-E, Lofer Kalvarienberg-Lärchberghörndl.
- Fig. 17. Transverse section, slightly oblique ; note micritic envelopping, sample LOF-4, Lofer Kalvarienberg-Lärchberghörndl.

Scale bars = 0.3 mm.



## PLATE 2

*Clypeina isabellae* MASSE, BUCUR, VIRGONE & DELMASSO, emend.,  
from the Late Jurassic (Kimmeridgian–Tithonian) of the Northern Calcareous Alps (Austria, Germany)

- Fig. 1. Transverse and longitudinal section, note: the bulge in the upper whorl; sample 853/1.  
Fig. 2. Sub-axial section; sample 853/3.  
Fig. 3. Axial section (fragment) showing the bulge and secondary enlarged pore (853/1).  
Fig. 4. Transverse and oblique section; sample 853/4.  
Fig. 5. Transverse section of a whorl with 13 laterals which are not lying in the same plane, instead corresponding to tangential section of overlapping laterals (compare Fig. 14); sample 853/5.  
Fig. 6. Transverse-oblique section; sample 853/4.  
Fig. 7. Transverse slightly oblique section cutting some bulges of laterals, note: thin primary calcification of the main axis; sample 853/4.  
Fig. 8. Slightly oblique transverse section passing through the lower part of whorl – through bulges; sample 853/5.  
Fig. 9. Transverse, slightly oblique section with, in the one lateral on right, clearly visible well preserved ampulla; sample 853/2.  
Figs. 10–14. Different tangential sections; the section in Fig. 14 with overlapping laterals corresponds to specimen as that one shown in Fig. 5; samples 853/4, 853/2, 853/3, 853/2, 853/1.  
Figs. 15–17. Different transverse-oblique and transverse sections, note thin primary calcification of the main axis in Figs. 16 and 17; samples 853/a, 853/1, 853/2.  
Fig. 18. Longitudinal-tangential section crossing 4 successive whorls; sample 853/a.  
Figs. 19–23. Different transverse-oblique and transverse section of small-sized specimens; samples 853/4, 853/1, 853/6, 853/7.  
Fig. 24. Transverse section with poorly preserved laterals. Some of the laterals are filled with secondary calcite (as in some other specimens also); sample 853/1.

Scale bar for all figures: in fig. 24 = 0.5 mm



## PLATE 3

Figs. 1–16. *Clypeina isabellae* MASSE, BUCUR, VIRGONE & DELMASSO, emend. from the Berriasian of the Sa Marghine Ruja stratigraphic section (Oliena, East Sardinia).

1–2. Different tangential sections; samples 833/7, 853.

3–5. Axial and sub-axial sections showing the bulge; samples 853/5, 853/4, 853/6.

6. Transverse section of large whorl with slightly recrystallized wall of the main axis and some laterals; note: in lower left corner, a specimen of *Nautiloculina bronnimanni* ARNAUD-VANNEAU & PEYBERNES; sample 855/b.

7. Transverse oblique section; sample 853/7.

8. Transverse section, note: thin primary colorless calcification of the main axis and of tubuliform laterals; sample 853/7.

9. Partly preserved transverse section in which the tubuliform shape of laterals with slightly recrystallized walls are well visible; sample 853/1.

10–11, 13. Different more or less oblique sections; samples 853/7, 853/4, 853/7.

12. Transverse section of a whorl consisting of 13 densely set laterals, some of them filled with calcite (dissolved and recrystallized internal moulds of ampulae; corresponding tangential section is that in Pl. 1, Fig. 10); sample 853/7.

14–15. Fragments of transverse oblique sections; sample 853/c.

16. Oblique section of whorl crossing bulges; sample 853b.

Figs. 17–20. "*Clypeina* A" PECORINI, 1972 original thin sections of the Pecorini Collection, Cr V3, V4 and V9; Purbeckian (Berriasian) of Nura, SW Sardinia.

17–19. Different transverse sections, PECORINI, 1972 – figs. 3f, 3a, 3c.

20. Oblique section, (this section Cr V9, was not illustrated by Pecorini).

Scale bar for figures 1–16: on Fig. 1 = 0.5 mm

Scale bar for figures 17–20 = 0.25 mm.



